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Title

[Kotai eizo soshi]

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Specification

1. Title of the invention

SOLID STATE IMAGE SENSING ELEMENT

2. Scope of the invention

Regarding the solid state image sensing element which consists by setting up a color mosaic filter(s) over the solid state image sensing element chip where a color mosaic filter(s) consists of an inorganic filter(s), the solid state image sensing element has the characteristics wherein the surface of light shielding part of above mentioned solid state image sensing element tip is composed of a low reflecting surface or a diffusing surface.

3. Detailed explanation of the invention

{Utilized fields in the industry}

This invention relates to the solid state image sensing element with a color mosaic filter(s) used for electronic endoscope attached.

[Prior arts and problems that this invention attempts to solve]

Traditionally, regarding solid state image sensing element with a color mosaic filter(s) (hereafter called as CCD), as a color mosaic filter(s), an organic filter(s) (absorption filer) that normally consists of gelatin etc has been used.

On the other hand, in case CCD with a color mosaic filter(s) attached is assembled into the electronic endoscope etc, it is necessary to minatialized as much as possible, and for that purpose, using a simplified packaging was necessitated. Its cross section structure is as shown in figure 3. It was configured such that inside of package 1, CCD chip 2 is housed in a fixed configuration and the surface of a color mosaic filter(s) 3 side of cover glass 4 with a color mosaic filter(s) 3 set up on the surface is adhered over the CCD chip 2 via adhesive agent layers, and then, using bonding wire 6, space between CCD chip 2 and package 1 is adhered, then, sealing material 7 such as synthetic resins is filled up into the surrounding part and solidified.

However, in case of simplified type packaging such as this, due to some air flow characteristics of sealing material 7 itself and insufficiency of sealability of sealing material 7 etc, complete sealed condition was not obtained, as described above, in case a color mosaic filter(s) is an organic filter(s), there arose problems wherein due to the impact of the moisture from outside atmosphere, color changed and it was made unusable.

Hence, in order to solve problems such as these, in stead of an organic filer(s) as a color mosaic filter(s), it was

proposed to use an inorganic filter(s) with moisture proof, however, since this inorganic filter(s) is an interference filter(s), following problems were produced: Newton rings or flare is easily produced and making it difficult to look at, making color reproducibility poor, and producing poor images with poor resolution and poor contrast.

It is conjectured that the causes that generated these phenomena are as follows:

Figure 4 is the enlarged cross section diagram of the main part of figure 3. On the surface of CCD chip 2, 2a is the light shielding part consisting of Al layers; 2b light receiving part that consists of Si layers; and these are set up in mosaic fashion.

(i)The reason why Newton rings is generated

Regarding the spectral characteristics of a color mosaic filter(s)3, in general as shown in figure 5, wave length area other than wave length band with transmission rate of 0% or 100% is quite wide, if a color mosaic filter(s)3 is an interference filter, as shown in figure 4, the light rays of above described light length area pass through the a color mosaic filter(s) 3, then, after reflecting by light shielding part 2a or light receiving part 2b, and when it arrives at a color mosaic filter(s)3, a part of it is transmitted, the remainder is not

absorbed but is reflected again, this reflected light rays (a) and the light rays that was transmitted through a color mosaic filter(s) 3 (however, the light rays have the same direction as reflected light rays (a)) interfere. This interference degree depends on the interval between CCD chip 2 and a color mosaic filter(s) 3, if both sides are slanted mutually, depending on the position, it strengthens or weakens, this manifests as Newton rings. Particularly, light shielding part 2a that consists of Al layer has high reflectivity, thus becoming the main reason that generates Newton rings. Furthermore, the reflectivity of light receiving part 2a is quite low as to be negligeable.

Suppose, for instance, transmission rate vis-à-vis the light rays of wave length with a color mosaic filter(s) 3 is 20 % and its reflectivity is 30%, when it passes a color mosaic filter(s) 3, the amount of light rays is 20%. These light rays are reflected almost 100% by light shielding part 2a that consists of Al layers and a color mosaic filter(s) 3 has 80% of reflectivity, then, the amount of light rays of reflected light rays here becomes 16% (0.20 x 0.80 = 0.16). if the reflected light rays of this amount of light rays 16%, and transmitted light rays of 20% of amount of light rays that were transmitted through a color mosaic filter(s) 3 interfere, light strength change within the range from 36% (20%+18%) to 4% (20% -16%) is produced. Images thus produced are very difficult to look at.

Furthermore, since Newton rings are produced by light interference, how they manifest greatly differs by possible coherency of incoming light. If the possible interference distance is sufficiently short, compared with the thickness of adhesive agent 5, interference rings are not generated. On the contrary, if the possible interference distance is long, interference rings appear conspicuously.

White light rays of sun light have very short possible interference distance, however, in the white light of mercury lamp, strong bright line spectrum is contained, and since possible interference distance of bright line spectrum is short compared with white color light, half interference rings is easily produced. And, if the light rays have properties wherein single color property such as in lasers is strong, and possible coherency is high, interference rings are more easily produced.

(2) The cause of generating flare

Regarding CCD using an inorganic filter(s) , as described above, multiple reflections between a color mosaic filter(s) 3 and light shielding part 2a are produced, hence, as shown in figure 4, a part of lights that were transmitted through adjoining color filter enters into receiving light rays part 2b as flare.

For instance, at the location where cyan (Cy) filter and yellow (Ye) filter are adjoining each other, sometimes the light rays of blue (B) and green (G) that were transmitted through a cyan filter are mostly reflected by light shielding part 2a, and enter into yellow filter,

Then, G light rays are almost all transmitted by a yellow filter, but B light rays are completely reflected. And, this reflected B light rays enter into light rays receiving part 2b that faces yellow filter, then, since this causes the light rays to come in wherein said light rays has ingredient that is not supposed to come in, this ends up in deleterious color reproducibility.

And, due to the above described multiple reflection, regarding a certain light ray receiving part, not limiting to the light rays that were transmitted through adjoining color filters, there are cases when light rays that were transmitted through filter quite far away can enter, thus causing the resolution and contrast to be lowered.

And, vis-à-vis a certain light receiving part by the above described multiple reflections, sometimes there are cases wherein not limiting to the light rays that were transmitted through adjoining color filters, some light rays come in that

were transmitted through color filters located at considerably distant places, this causes the decreases of image resolution and contrast.

In view of the above problems, the purpose of this invention is to provide the solid state image sensing element that obtains the image that are easy to look at and has good reproducibility, good image resolution and high contrast.

[Means to solve the problems and interaction]

Regarding the solid state image sensing element by this invention, in the solid state image sensing element which is formed by setting up a color mosaic filter(s) that consist of an inorganic filter(s) over the solid state image sensing element chip, the surface of light shielding part of above described solid state image sensing element chip is configured by low reflection surface or diffusing surface, thereby, light rays that are transmitted through a color mosaic filter(s) are almost prevented from doing harmful reflection over the light shielding part.

[Embodied examples]

In the following, based on the embodied examples shown in the figures, parts identical to the above described prior arts

use the identical symbols and this invention will be explained in details.

Figure 1 is the enlarged cross section drawing of the main part of the first embodied example. The surface of light shielding part 2a is formed into a reflecting surface 2c by the black alumite treatment. Furthermore, low reflecting surface 2c can be formed by adhering black colored material such as chromium oxide on the surface of light shielding part 2a, or, for instance, it can formed by coating a black colored filter such as gelatin etc.

Since the solid state image sensing element by this invention is configured as above, light rays that have been transmitted through a color mosaic filter(s) 3 hardly reflect over the light shielding part 2a by the action of low reflective surface 2c. Accordingly, light rays that go toward a color mosaic filter(s) 3 by reflecting over CCD chip 2 hardly exist, Newton rings by the interference of light rays as in the prior arts are hardly generated, as a result, images that are easy to look at are produced. And, due to the same reason, a great deal of reflection between a color mosaic filter(s) 3 and light shielding part 2a are hardly generated, flare as in the example in the prior arts are not produced, as a result, images are produced wherein it has good color reproducibility, high resolution and high contrast.

Furthermore, even if the surface of light shielding part 2a is formed into a dispersing surface by chemical treatment and mechanical treatment, since light rays are dispersed in every direction on the surface, there is no light interference, Newton rings are not generated. And, dispersed light rays evenly travel over the entire surface of CCD chip 2, color shift is prevented.

Second figure shows the second embodied example, This forms light shielding part 2a itself by using low reflection material such as moribdenum etc, light rays that are transmitted through a color mosaic filter(s) 3 is made so that it hardly reflects over the light shielding part 2a '. It has the same effects as that of above described first embodied example.

[The effects of invention]

As described above, solid state image sensing element by this invention has the important advantage in utilization in that images are easy to look at and have color reproducibility, good resolution and contrast.

4. Simple explanation of drawings

Figure 1 is the enlarged cross section drawing of the main part of the first embodied example of solid state image sensing element by this invention; figure 2 is the enlarged cross section of the main part of the second embodied example; figure 3 is the cross section drawing of the solid state image sensing element of simplified package type; figure 4 is the enlarged cross section of the main part of figure 3; figure 5 is the drawing of the spectral characteristics of a color mosaic filter(s) .

1... package, 2… CCD chip, 2a, 2a'… light shielding part, 2b… light receiving part, 2c … low reflection part, 3…. A color mosaic filter(s), 4.. cover glass, 5…adhesive agent, 6… bonding wire, 7… sealing material

Representative

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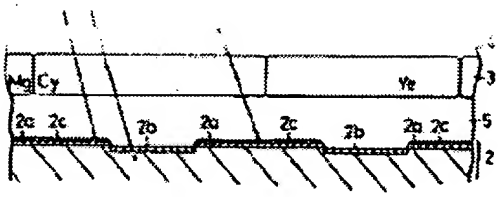
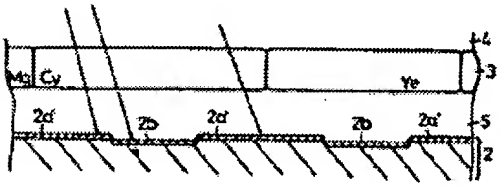
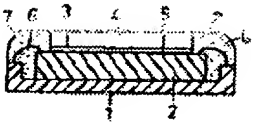
才1図



才2図



才3図



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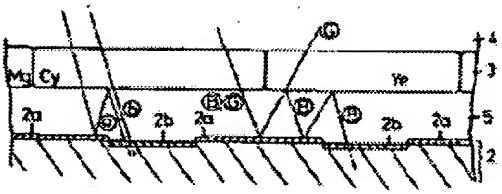

才5図